Electronic Version
Stylesheet Version v1.1.1

Description

[TRANSMISSION MECHANISM OF SHEET FEEDER]

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority benefit of Taiwan application serial no. 91119633, filed August 29, 2002.

BACKGROUND OF INVENTION

[0002] Field of the invention

[0003] The present invention is generally related to the transmission mechanism of a sheet feeder, and particularly, to the transmission mechanism of a shrunk-size sheet feeder.

[0004] Description of related art

[0005] Following the advancement and rapid development in the electronics industry, it has risen to become the most important industry of our current society. A variety of different processing systems are introduced therefore leading to the popularization of electronic products in our daily lives. In the recent years, the processing speed and stor-

age capability of CPUs and personal computers have greatly increased. As a result, the efficiency of image processing is greatly enhanced allowing consumers to enjoy image-processing devices such as optical scanners and digital cameras.

[0006] The different categories of image document inputs are optical pocket scanner, sheet feed scanner, drum scanner, and flatbed scanner, or the like. Sheet feed scanners are geared towards lighter, thinner, shorter, and smaller, and therefore the feed mechanism of the sheet feed scanner has to be correspondingly reduce in size.

[0007] Please refer to FIG. 1, a schematic diagram of a conventional sheet feeder is shown. The sheet feeder 110 is used for feeding a document 150 and the sheet feeder 110 comprises of a sheet feeder body 162, a feed-in tray 112, a feed-out tray 128, three drive rollers 114, three idle rollers 118, a separate roller 126, a feed roller 122, and a separate plate 124. Feed roller 122 is located inside the sheet feeder 110 at one end of the feed-in tray 112. The drive rollers 114 and idle rollers 118 are located inside the sheet feeder 110, where the drive roller 114 and idle roller 118 are grouped together to transport a document 150 by having a pair of drive roller 114 and idle roller 118

to make contact with different faces of the document 150. The separate roller 126 and the separate plate 124 are both located inside the sheet feeder 110, wherein the separate roller 126 is placed above the separate plate 124 and they are both in contact. The material of the separate roller 126 is a flexible material, therefore when a stack of sheets passes through the separate roller 126 and the separate plate 124 the separate roller will only allow one piece of paper to pass through under ideal situation. This is due to the friction between the separate roller 126 and the to-be-fed sheet is greater than that between sheets and between the sheet and the separate plate 124.

[0008] Feed roller 122 feeds a document 150 in a first direction 120 towards the passage created between the separate roller 126 and the separate plate 124 and by combining the design of the separate roller 126, the separate roller 126 and the separate plate 124 will only allow one document 150 to pass through at each time. After passing through the passageway between the separate roller 126 and separate 124 plate, the document 150 will be fed in a second direction 140 towards the passage between the drive roller 114 and the idle roller 118. The drive roller 114 and the idle roller 118 together clamp both sides of

the document 150 and then feed in a third direction 160. When the document 150 is at the scan entrance 116, the document 150 is fed through the scan entrance 116 in the third direction 160 until the scanner 132 has finished scanning the image of the document 150 and the drive rollers 114 exits the document to the feed-out tray 128.

[0009] In the above-described sheet feeder 110, the drive rollers 114, the idle rollers 118, the separate roller 126, the feed roller 122, and the separate plate 124, etc... of the sheet feeder 110 all occupy significant space inside the sheet feeder 110. Therefore the sheet feeder 110 requires a relatively large volume to accommodate all these components. Furthermore, the conventional sheet feeder 110 relies on pairs of drive rollers 114 and idle rollers 118 to feed a document 150. The drive rollers and idle rollers 118 use a point-contact method to feed documents, which easily causes slippage of document 150 that affects the quality of the scan.

[0010] An object of the present invention is to provide a transmission mechanism which reduces the total number of rollers to reduce the space occupied by the rollers and furthermore to effectively shrink the size of the sheet feeder.

[0011] Another object of the present invention is to provide a transmission mechanism which uses face-contact method to feed documents, which feeds in accurately for scanning to improve scan quality.

SUMMARY OF INVENTION

[0012] In order to achieve the above objects, the present invention provides a transmission mechanism comprising three drive rollers, a idle roller, a belt, and an elastic member. The belt tightens around the drive rollers to drive all of drive rollers simultaneously. The elastic member activates the idle roller causing the idle roller to exert a force on the belt to move the document between the idle roller and belt during transportation. This setup can reduce the total number of rollers (including drive rollers and idle rollers) to reduce the size occupied by the rollers for effectively reducing the size of the sheet feeder. The elastic member exerts an elastic force, which is tangent to the document and the idle roller, on the idle roller to generate a friction between the belt and the document in order to move the document. The elasticity of the elastic member can adjust the distance between the belt and idle roller so the transmission mechanism can accommodate documents that are relatively thick. Furthermore, the contact between the belt

and idle roller is a face-to-face method to transport the document so the surface friction between the belt and document is greater than that between the idle roller and document. As a result the transportation of the document is more accurate. The elasticity of the elastic member will push the idle roller towards the belt so slacking of the belt will be tightened to resume normal operation of the transmission mechanism.

[0013] In accordance to the above, the present invention reduces the total number of rollers (including drive rollers and idle rollers) to reduce the space occupied by the rollers for effectively reducing the overall size of the sheet feeder. The transmission mechanism uses a face-contact method to transport documents so that the document and belt can have direct face contact for a more accurate delivery.

[0014] It is to be understood that both the foregoing general description and the following detailed description are exemplary, and are intended to provide further explanation of the invention as claimed.

Brief Description of Drawings

[0015] The accompanying drawings are included to provide a further understanding of the invention, and are incorporated in and constitute a part of this specification. The

drawings illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

[0016] FIG. 1 is a schematic diagram of a conventional sheet feed scanner.

[0017] FIG. 2 is a schematic diagram of the sheet feed scanner according to one preferred embodiment of the present invention.

[0018] FIG. 3 is schematic diagram the transmission mechanism of the sheet feed scanner according to one preferred embodiment of the present invention.

[0019] FIG. 3A is the top view of the transmission mechanism illustrated in FIG. 3.

[0020] FIG. 3B is a schematic diagram illustrating the relationship between the belt, idle roller, elastic member, and document of FIG. 3.

[0021] FIG. 3C is a schematic diagram illustrating a tightened belt in the relationship between the belt, idle roller, elastic member, and document of FIG. 3.

[0022] FIG. 3D is a schematic diagram illustrating a slacked belt in the relationship between the belt, idle roller, elastic member, and document of FIG. 3.

DETAILED DESCRIPTION

[0023] Please refer to FIG. 2. FIG. 2 shows the schematic diagram of the sheet feed scanner according to one preferred embodiment of the present invention. The sheet feeder 210 comprises of a body 262, a feed-out tray 213, a feed-in tray 212, a feed-in roller 222, a feed-out roller 228, and a transmission mechanism 300. The feed-in tray 212 and feed-out tray 213 are located outside the body 262 where the feed-in tray 212 is located above the feed-out tray 213. The feed-in roller 222, feed-out roller 228, and transmission mechanism 300 are all located inside body 262. The feed-in roller 222 is disposed at one end of the feed-in tray 212 and the feed-out roller 228 is disposed at one end of the feed-out tray 213. The transmission mechanism 300 is located at a side of the feed-in roller 222 and feed-out roller 228. Furthermore, the sheet feeder 210 has a scan entrance 216 located directly below the sheet feeder 210. The scan module 232 receives the document 250 by the sheet feeder 210 through the scan entrance 216 of sheet feeder 210. The document 250 will be automatically transported through scan entrance 216 allowing the scan module to perform a scan of the image of the document 250. After scanning of the document 250 by the scan module 232, the document will be transported

to the feed-out tray 213. In this preferred embodiment, the document 250 is a piece of paper.

[0024] Please simultaneously refer to FIG. 3 and FIG. 3A. FIG. 3 is a schematic diagram of the transmission mechanism and FIG. 3A is the top view of the transmission mechanism according to the preferred embodiment of the present invention. The transmission mechanism 300 comprises of three drive rollers 214, a idle roller 226, a belt 229, and an elastic member 227. Each drive roller 214 further comprises an axle 218, which penetrates the center of the drive roller 214 and has its two ends fixed on the body 262. The drive rollers 214 revolves about the axle 218, whereby at least one of the drive rollers 214 must provide a driving motion to drive belt 229 and other passive drive rollers 214. The arrangement of the three drive rollers 214 forms a substantially triangular shape with the drive rollers 214 at the three edges. The triangular shape can be an acute triangle, right-angle triangle, or obtuse triangle. The number of rollers 214 of the present invention is not limited to only 3 as shown in the preferred embodiment but can be any other integer number of rollers. The belt 229 tightens around the drive rollers 214. The belt 229 can be multiple pieces of belt tightened around drive

rollers 214. The idle roller 226 further comprises a shaft 219 which penetrates the center of the idle roller 226 and has its two ends fixed on the body 262. The idle roller 226 revolves about the shaft 219. One end of the elastic member 227 is fixed on the shaft 219 and the other end of the elastic member 227 is fixed on the body 262. The elastic member 227 is a spring in this preferred embodiment and furthermore can be manufactured as a whole with the body 262 by injection molding. The body of elastic member 227 possesses elasticity which allows the idle roller 226 to be pressed against the belt 229 to maintain a certain tightness of the belt 229. In effect of the above, the transmission mechanism 300 reduces the total number of rollers (including drive rollers and idle rollers) to reduce the size occupied by them for reducing the overall size of the sheet feeder 210.

[0025] Please simultaneously refer to FIG. 2, FIG. 3, and FIG. 3B. FIG. 2 is a schematic diagram of the sheet feed scanner, FIG. 3 is a schematic diagram of the transmission mechanism, and FIG. 3A and FIG. 3B is a schematic diagram showing the relationship between the belt, idle roller, elastic member, and document according to the preferred embodiment of the present invention. The transmission

mechanism uses a motor (not illustrated) for providing a driving source to one of the drive rollers 214 to turn feed-in roller 222 and feed-out roller 228 for feeding a document 250 in the feed-in tray 212 towards a first translation direction 220, whereas the document is a piece of paper. After passing the feed-in roller 222, the document 250 is moved towards the passageway between the idle roller 226 and belt 229. The drive rollers 214 rotate in a first rotation direction 301 to drive the belt 229, and the belt 229 drives the idle roller 226 in a second rotation direction 302. As a result the document 250 passing through the passageway between the belt 229 and idle roller 226 is fed in a second translation direction 240. As illustrated in FIG. 3B, the document 250 causes the idle roller to move to the right resulting in a tangent force on the document 250 by the idle roller 226. Therefore a friction is generated between the document 250 and belt 229 for transporting the document 250 forward to pass through the passageway between the belt 229 and idle roller 226 towards a third translation direction 260. The contact between the belt 229 and document 250 is a face-contact method, whereas the contact surface friction between the belt 229 and document 250 is greater than

that between the idle roller 226 and document 250. Furthermore, the elasticity of the elastic member 227 can adjust the distance between the idle roller 226 and document 250 to accommodate documents of different thickness.

[0026] Please simultaneously refer to FIG. 3C and FIG. 3D. FIG. 3C shows a schematic diagram of the relationship of the tightened belt, idle roller, and elastic member of FIG. 3. FIG. 3D shows a schematic diagram of the relationship of the slacked belt, idle roller, and elastic member of FIG. 3. When transmission mechanism 300 is in normal operation and before the belt 229 becomes slack, the contact between the belt and the idle roller 226 is balanced. At this instant, the distance of the elastic member 227 from the center of the shaft 229 to the body 262 is a first distance of 30, as shown in FIG. 3C. After long operation of the belt 229, slacking will occur in belt 229 but it is compensated by the elasticity of the elastic member 227 by pushing the idle roller 226 towards the belt 229 until the belt 226 and belt 229 maintain a balance. At this moment, the distance of the elastic member 227 from the center of the shaft 229 to the body 262 becomes a second distance of 40, wherein the second distance 40 is greater than the

first distance 30. In other words, even after slacking occurs, the elasticity of the elastic member 227 can retain the belt in a condition without slacking to resume normal operation of transmission mechanism 300.

[0027] According to the above, the advantage of the present invention is a reduced total number of rollers (including drive rollers and idle rollers) to reduce the space occupied by the rollers for reducing the overall size of the sheet feeder.

[0028] The second advantage of the present invention is the face-contact method used in the transportation for better accuracy of document feeding.

[0029] The third advantage of the present invention is that the elasticity of the elastic member can adjust the distance between the idle roller and belt for accommodating documents of different thickness.

[0030] The fourth advantage of the present invention is the slacking of the belt can be compensated for resuming normal operation of the transmission mechanism.

[0031] It will be apparent to those skilled in the art that various modifications and variations can be made to the structure and method of the present invention without departing from the scope or spirit of the present invention. In view

of the foregoing description, it is intended that the present invention covers modifications and variations of this invention provided they fall within the scope of the following claims and their equivalents.